

City of Newport Beach

**Newport Beach City
Hall and Park
Development Plan**

Final Water Quality
Management Plan

Final

City of Newport Beach

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Hall and Park
Development Plan**

Final Water Quality
Management Plan

Grading Permit No:

Building Permit No:

Tract No:

Prepared for:

City of Newport Beach

Public Works Department

City Hall, Building C

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party

Job number 208597-91

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Owner's Certification

Water Quality Management Plan (WQMP)

Project Name: Newport Beach City Hall and Park Development Plan

TRACT/PARCEL MAP NUMBER: _____

This Water Quality Management Plan (WQMP) has been prepared for The City of Newport Beach. The WQMP is intended to comply with the requirements of the City of Newport Beach Municipal Stormwater Permit (California Regional Water Quality Control Board – Santa Ana Region, 2009) which requires the preparation of WQMPs for priority development projects. Since the Newport Beach City Hall and Park Development Plan is a commercial development greater than 100,000 square feet (including parking area), it is designated as a Priority Project according to the Orange County Drainage Area Management Plan (DAMP).

The mitigative measures included in this WQMP comply with the DAMP and additionally are consistent with the Low Impact Development (LID) approach identified in the recently adopted fourth term MS4 Permit (R8-2009-0030). They place the highest priority for BMPs that remove storm water pollutants and reduce runoff volume through infiltration, then on other BMPs which reduce runoff volume through harvesting and re-use and evapotranspiration and finally on BMPs that treat stormwater through bio-treatment. These LID BMPs are proposed at the project site in a manner consistent with the maximum extent practicable standard.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this WQMP. The undersigned will ensure that this plan is carried out and amended as appropriate to reflect up-to-date conditions on the site consistent with the current City of Newport Beach Urban Runoff Management Program and the intent of the NPDES/MS4 Permit for Waste Discharge Requirements as authorized by the State and EPA. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

To be completed by the Owner or Developer.

Signed: _____

Name: _____

Title: _____

Company: _____

Address: _____

Telephone #: _____

Date: _____

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1 Discretionary Permits and Water Quality Conditions

No discretionary permits or water quality conditions are required at this time.

2 Project Description

The proposed Newport Beach City Hall and Park is a civic building project located on approximately 17.6 acres of land between Avocado Ave. and MacArthur Blvd, directly north of the existing Newport Beach Central Library. The site is owned by the City of Newport Beach. The site includes a 4.0-acre south parcel on the existing Central Library site, a 14.2 acre central parcel, and a 3.4-acre north parcel. The central parcel is divided into a 7.9 acre central park area, and a 6.3 acre south park area. These areas exclude the new San Miguel Drive expansion which splits the north and central parcels.

The site is a linear median approximately 450 feet wide at its southern end tapering evenly to a width of 128 feet at the northern end. A vertical change of 120 feet occurs within its overall length of 2570 feet. An existing drainage bisects the central parcel of the site. The channel of the drainage includes a wetland that falls under the jurisdiction of both the California Department of Fish and Game and the Army Corps of Engineers.

The proposed project includes six primary components including: (1) construction and operation of an approximately 98,000-square-foot (sf) City Hall building, meeting hall, and Council Chambers; (2) a 450-space parking structure; (3) an approximately 17,000 sf expansion of the Newport Beach Central Library (Library); (4) construction of a 14.3 ac public park; (5) widening of San Miguel Drive; (6) re-use of the existing City Hall structures with commercial office uses; and (7) an Emergency Operations Center.

Impervious areas on the site include all of the structures, roadways, surface parking, plazas, walkways, terraces, overlooks and the dog park. Combined, the proposed plan site is approximately 39% impervious. The existing site is approximately 5% impervious. These values exclude the impervious area of San Miguel Drive which is included in drainage area Bv in Table 1.

Significant program elements are described in more detail below, along with specific aspects of the project relating to water quality management and low impact development features. An overall site plan is provided in Figure 1.

The City Hall landscapes will be maintained by City maintenance staff. Aside from normal garbage and food waste there are no significant sources of waste generation planned that will require alternative disposal means. Hazardous chemical or material storage shall be limited to a fuel storage tank for the emergency generator. This will be located just south and west of the southern parking structure access driveway. The current design is for the generator to be mounted above the fuel storage tank.

Figure 1: Site Plan



2.1 City Hall

The City Hall facility is composed of six modular sections (Bays) and a free standing council chamber. Service related functions within the City Hall include a catering kitchen, audio visual control room and mechanical rooms. The City Hall building includes a truck loading dock at its southern end between the City Hall and the Library expansion. Deliveries will include food and associated products for the catering kitchen, as well as office supplies and equipment. It is not anticipated that chemical deliveries will occur, other than small amounts of typical cleaning agents and periodic shipments of diesel for an emergency power generator. An underground Emergency Operations Center (EOC) will be constructed between the City Hall building and the parking structure beneath the terrace café.

The total footprint of the City Hall Building is approximately 75,100 square feet including the area covered by the awning.

2.2 Land Uses

This section describes the various land uses that will occur at the City Hall site.

2.2.1 Parking and Roadways

Parking at the site includes two areas of surface parking and a partial underground 3 story parking structure. There are three new internal site roadway surfaces associated with the development. These include the main entrance and turnaround, the maintenance and truck access area, and the parking structure exit road to the south.

2.2.1.1 Surface Parking

Surface parking is provided at two locations at the site. 20 diagonal surface parking spaces occupying 3500 square feet will be provided at the north western end of the site along Avocado Avenue. An additional 26 perpendicular surface parking spaces occupying 6800 square feet are included in the south park area on either side of the driveway just north of the parking structure entrance.

2.2.1.2 Parking Structure

The 450-space, cast-in-place, post-tensioned concrete parking structure will function as the primary parking for staff and visitors to the city hall. The top level of the parking structure is not covered, and occupies approximately 50,000 square feet. Open on the north, west, and east facades, the structure will primarily be naturally ventilated with supplemental mechanical ventilation. On the west façade is a tall manicured hedge to help screen the view of parked cars from the City Hall building.

The main entrance is from the north end while the secondary entrance will be at the southern end near the Central Library. The structure is positioned parallel to MacArthur Blvd. Landforms on the MacArthur Blvd. edge of the parking structure drain towards MacArthur Blvd. and will be planted so that the garage will be screened and will not impact the views from MacArthur Blvd.

2.2.1.3 Roadways

The new main entrance to the site includes 24 and 36 foot wide roadway as well as a drop off/turnaround area. The surface area of the drop-off/turnaround is approximately 10,500 square feet. The roadway terminates at the entrance to the parking garage. The total paved surface of the main entrance is approximately 22,000 square feet.

The southern entrance along Avocado Avenue is primarily for maintenance and truck access to the City Hall and Library. It includes a truck loading dock and turnaround. The total area of the maintenance access roadway is approximately 8000 square feet.

A secondary entrance to the parking structure runs along the east side of the Central Library. This roadway is 24 feet wide and 333 feet long, occupying a surface area of about 8000 square ft. An expansion of the existing cooling tower will occur along this road, adding approximately 500 square feet to the current facilities.

The combined total area of new roadway on the site is approximately 38,000 square feet or about 0.9 acres.

2.2.2 Library Expansion:

The proposed design includes approximately 17,000 square feet of additional space for the Central Library. The expansion is located on the north side of the existing library. This two-story addition includes approximately 9,300 square feet of additional reading room space and expanded children's areas, as well as an espresso bar and space for an employee credit union. This espresso bar and credit union are located adjacent to the major new north facing entrance to the library.

2.2.2.1 Dog Park

An approximately 24,000 square foot dog park is located in middle of the north parcel of the project. The dog park is an enclosed, open space area that will be surfaced with artificial turf or a similar material. One product currently being considered is K9Grass. The system will require daily wash-down using a sprinkler system and will drain via subsurface collection. This facility requires special attention in the WQMP in order to manage for nutrients and fecal coliform as well as other common surface pollutants.

2.2.3 Open Space and Parkland

A large portion of the site will be open space. Open space areas will vary in character including civic gardens, multiple lawns or meadows, habitat for native flora and fauna, forested areas, trails, small structures to enhance park programming, and extensive planting. Site circulation will be dominated by ADA accessible paths made of stabilized asphalt that connect the various usable levels of the site. Stairways may ultimately be incorporated in a few key locations as a more direct route between path switchbacks. Careful shaping of the sloping topography between levels will provide continuity and visual balance among the elements. Areas for runoff conveyance and treatment, including vegetated swales, vegetated filter strips and bio-retention basins will be scattered throughout the open spaces.

In addition to the dog park, the north park area includes sloping trails flanked by naturalized drainage swales, and forested lands. A belvedere with a small pavilion occupies the high point of the north park.

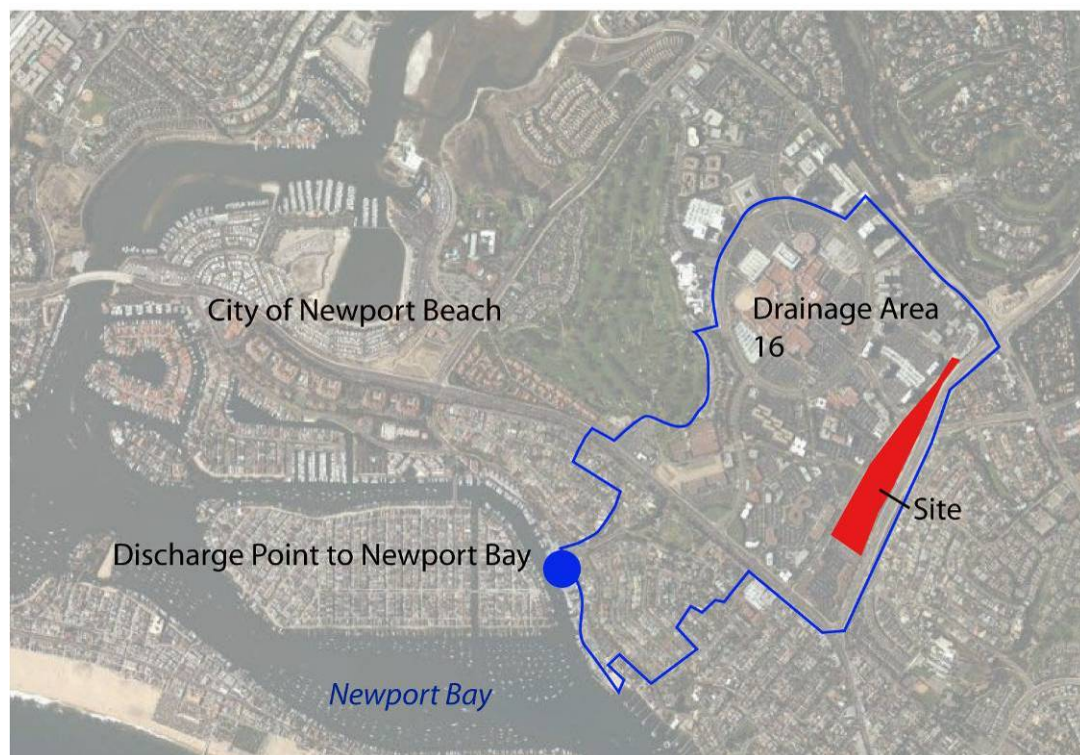
Within the central park area, the focus is on the existing drainage and wetlands with steep vegetated slopes that form its sides. The east and west zones of the central park will be re-graded to provide meadow areas and will include intensifications of planting design as well as picnic tables. An overlook at the high point near MacArthur Blvd. will emphasize the long view of the wetland. Two lightweight steel bridges and a large arched culvert cross over the wetlands. Planting will emphasize native flora and creation of animal habitat as well as the creation of settings or characters within the park. The existing sidewalk along Avocado Ave. will be moved into the site's interior, providing both a larger scale landscape and shade to the pedestrian user.

2.2.4 Program Area

The south park area, around the City Hall buildings, will be the most formal and heavily programmed area of the site. An arrival garden and formal entry into a vehicular drop off area will serve as the symbolic foreground to the City Hall buildings. Planting in the arrival garden will be subtropical, utilizing both lush and dry species to compose a rich and dense edge for the project. The existing sidewalk for Avocado Ave. will be integrated into the site, providing a planted buffer and presence along Avocado Ave. Pedestrian circulation will be further protected from vehicles by lines of bollards in the plaza. Concrete stairs serving the council chamber and the community room will connect to the south and land approximately 3'-0" lower on a paved terrace continuing along the east side of City Hall that may be a concrete unit paver of different scale. A terrace paved in irregular flagstone is immediately to the east of the community room and will be more organic and less monumental in its design. Additional concrete stairs connect approximately 3'-6" lower to the civic green area. Framed to its west by a linear terrace paved in concrete unit pavers underneath the building roof, the civic green is a perfectly graded plane constructed of under drained lawn similar to an athletic field and bisected by a series of simple paved walks which connect the Parking Structure to City Hall. Sheared hedges front the garage to the east. The café terrace, a 7,500 square foot open space, anchors the south end and will be paved and shaded with select trees. Planting of medium scale pines and under story shrubbery creates a buffer between the new building and the library. Concrete retaining walls will accommodate the service functions along the west side. Stormwater vaults for reducing peak runoff during large storm events and for capturing and reusing runoff will be created below the surface due to limited area available at the surface and the limited infiltration capacity of the soils. A planting of dense shrubbery along the east face of the garage, along MacArthur Blvd, will assist with screening as well as the integration of this more heavily developed site area with its northern counterparts. Stormwater treatment in detention basins and vegetated swales will be focused towards the southern portion of the south park area.

3 Site Description

The Site is located in Orange County, in the City of Newport Beach at the location indicated in Figure 2. The location of the existing Library is 1000 Avocado Ave. The site is a 20-acre wedge shaped property between Avocado Avenue and MacArthur Boulevard and bisected by San Miguel Drive. The City Hall building will be located at approximately 33° 36' 32.19" N latitude and 117° 52' 19.98" W longitude.

Figure 2: Site location and watershed overview

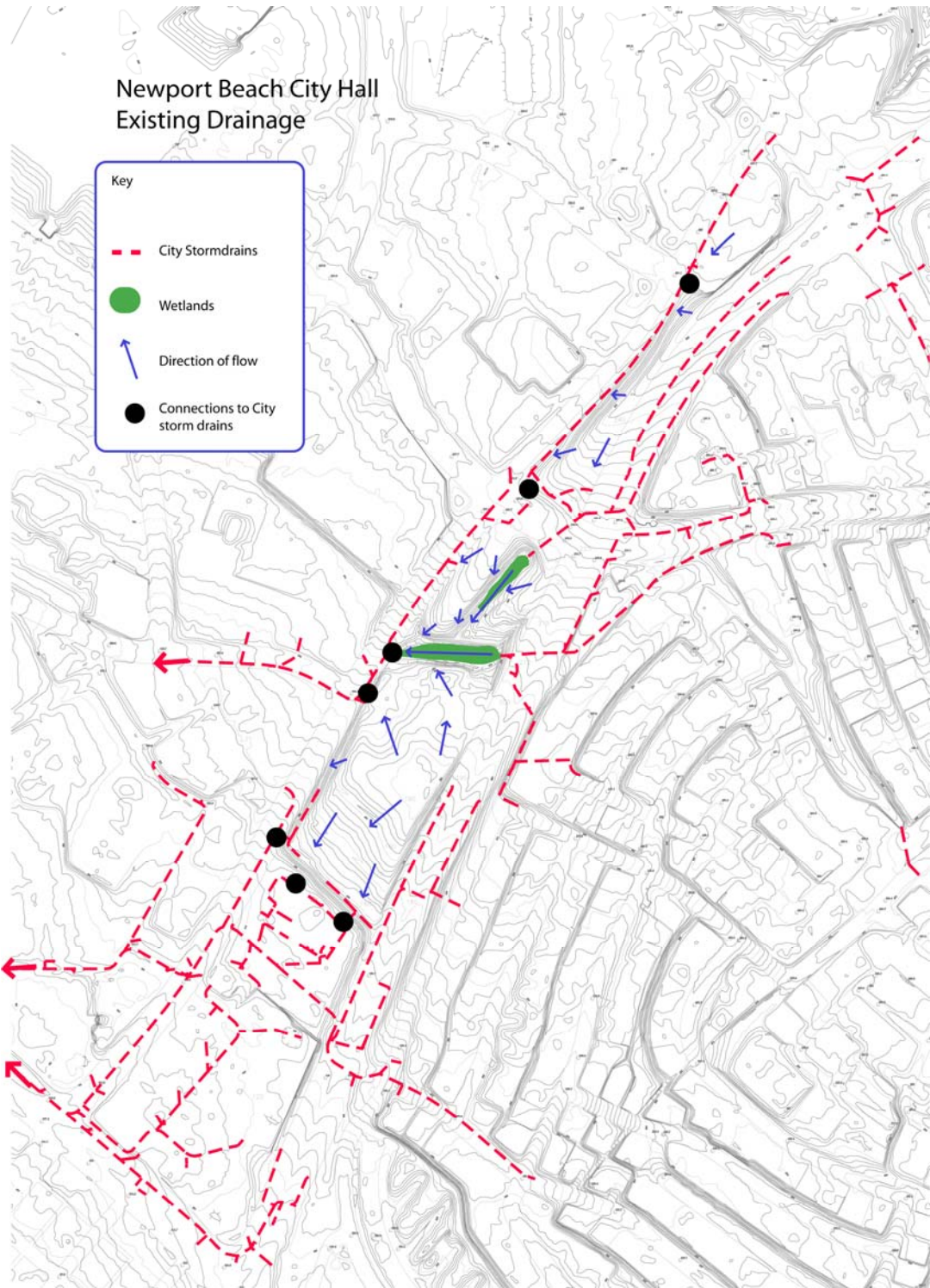
3.1 Drainage

3.1.1 Existing Drainage

The project site is located within Drainage Area 16 which drains to Lower Newport Bay at a single discharge point at the terminus of El Paseo Drive, indicated in Figure 2 (City of Newport Beach, 1987). The storm drain system downstream of the site does not daylight prior to reaching the Bay.

The existing on-site drainage system connects to the City drainage network in Drainage Area 16 at six locations. These are indicated in Figure 3. The only off-site runoff that enters the site is from the residential community on the east side of MacArthur Blvd. The contributing water shed is approximately 50 acres. This runoff daylights within the site at the east side of the existing wetland. Dry weather flows are thought to be the primary year-round source of water for the wetland area. It is not known whether seasonal groundwater interaction also contributes to the wetland's hydrology.

Figure 3: Existing site drainage



3.1.2 Proposed Drainage

The project will result in changes to grade, particularly within the southern portion of the site near the City Hall and Parking structure. This area will be lowered by as much as 40 ft to bring the buildings to a similar elevation as Avocado Ave to the west. However, the drainage pathways will not change substantially from those indicated in Figure 3. In most areas of the site, on-site drainage will rely on surface drainage techniques such as swales and channels. Storm drains and culverts crossing paved areas will be installed at a number of locations as indicated in Figure 10. Sub-drains beneath planting beds shall be used minimally as required to maintain plant health by reducing the occurrence of sub-surface ponding and anaerobic conditions.

With a single exception, off-site runoff shall not combine with on-site runoff prior to treatment. Within drainage area Bv, identified in Table 1, off-site runoff from San Miguel Drive and Avocado Avenue shall combine with site runoff within the treatment BMPs. The intention at these BMPs is to provide treatment of runoff from the new San Miguel Drive expansion as well as a portion of Avocado Ave.

Based on the site plan and proposed grading, the site shall be divided into 5 primary drainage areas, each discharging to the City storm drain system at a distinct location. These are labeled A through E in Figure 4. Properties of the drainage areas and sub drainage areas, including total area and percent imperviousness are provided in Table 1.

Figure 4: Site drainage and sub-drainage areas



SITE DRAINAGE and SUB-DRAINAGE AREAS

KEY



Drainage area



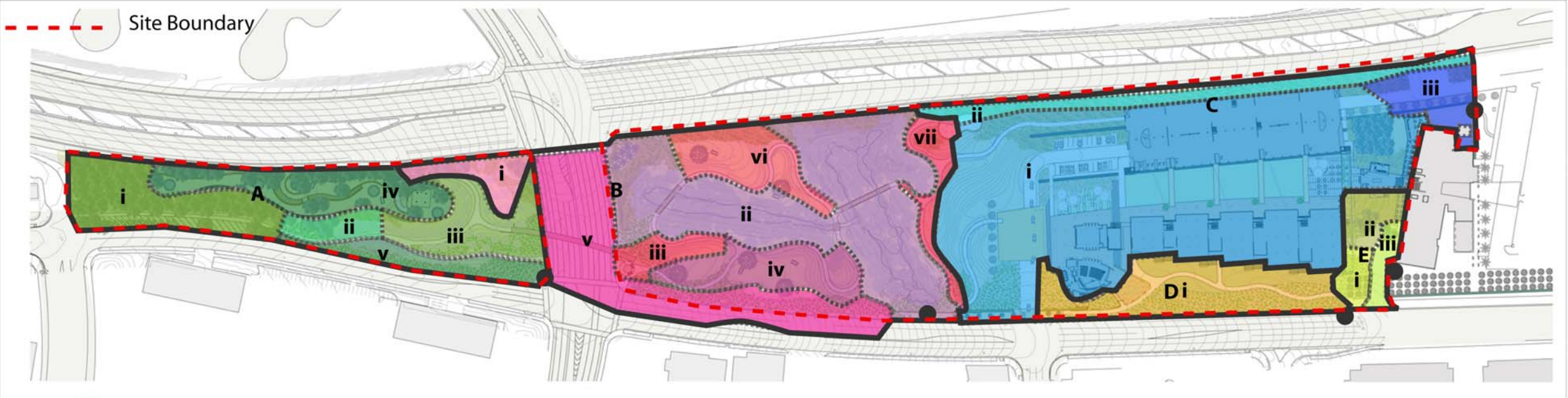
Sub-drainage area handled
by 1 primary water quality BMP



Point of discharge to City
storm drain



Site Boundary



200 400
ft

NEWPORT BEACH CITY HALL AND PARK
NEWPORT BEACH, CALIFORNIA

Table 1: Proposed drainage and sub-drainage area properties

Drainage ID	Drainage Area (sqft)	Total Impervious Area (sqft)	Approximate % pervious
Ai	38008	10099	73%
Aii	7157	1173	84%
Aiii	30066	6357.235	79%
Aiv	37461	37460.5499	0%
Av	18622	0	100%
A subtotal	131314	55090	58%
Bi	16637	765	95%
Bii	127885	2074	98%
Biii	10486	2363	77%
Biv	30056	4785.5	84%
Bv	64248	44931	30%
Bvi	24405	3672	85%
Bvii	13029	2373.5	82%
B subtotal	286746	60964	79%
Ci	281085	177100	37%
Cii	17727	0	100%
Ciii	28384	10250	64%
C subtotal	327196	187350	43%
Di	49733	6196	88%
Ei	4365	1160	73%
Eii	9028	1776	80%
Eiii	7471	4314	42%
E subtotal	20865	7250	65%
Total Area	815854	316849	61%
Total Area (acres)	18.7		
Area outside Limit of Work	50370		
Actual Site Area	765483	266479	65%
Site Area (acres)	17.6		

Note that the total area of these drainage areas is greater than 17.6 acres due to the inclusion of portions of San Miguel Drive and Avocado Avenue in the Bv catchment. These areas total about 1.1 acres and are not within the project boundary. Total percent perviousness increases to about 65% when these two areas are excluded from the calculation.

3.1.3 Soil Drainage Characteristics

Engineered top soils shall be used across all of the newly landscaped areas at the site to provide an appropriate growing medium for vegetation as well as absorption and retention of rainfall. The typical specified soil shall consist of sandy loam and shall, at the time of installation, have an infiltration rate of between 3 and 10 inches per hour, or an average of 6.5 inches per hour.

This average infiltration rate needs to be adjusted to account for long term permeability reductions resulting from siltation, bio-clogging and leaf litter buildup. Frequency of maintenance activity also plays a role in long term infiltration rates. The City of Tacoma Washington Surface Water Management Manual (City of Tacoma, 2008) recommends a method for adjusting known soil infiltration rates to account for these factors. Using adjustment factors of 1.5 for site heterogeneity, 3 for long term maintenance, and 3 for influent control, the long term infiltration rate at the site can be estimated to be 0.9 inches per hour. (6.5 inches per hour / (1.5+3+3) = 0.9 inches per hour) Additional details regarding this method can be found in the City of Tacoma Surface Water Management Manual. This value was used in this WQMP in order to calculate losses to soil within BMPs.

Infiltration rates in typical open spaces can be inferred from the methodology recommended in the MS4 permit for calculating stormwater runoff during the water quality design storm. The amount of water remaining on-site in an open space area during the water quality event is 0.6 inches, equivalent to $1 - C(0.15) * d$ (0.7 inches) where C is the runoff coefficient and d is the rainfall depth. Since the duration of the storm is 24 hours, the average infiltration rate in open space can be inferred to be about 0.025 inches per hour. The design rainfall intensity for the same storm event is 0.2 inches per hour and can be interpreted as the maximum rainfall intensity over the 24 hour period. Both the inferred infiltration rate and the maximum rainfall intensity are less than the anticipated long term infiltration rate of 0.9 inch per hour obtainable with engineered soils as discussed above. Therefore, the engineered soils shall be capable of infiltrating all of the rainfall during the water quality design storm, reducing runoff from open spaces to essentially zero.

The soil profile shall consist of about 0.25 feet of mulch over a minimum of 1 foot of planting soil. At the wilting point, sandy loam soils contain about 1 inch of water per foot of soil and have an excess water holding capacity of about 1.5 inches per foot of soil (USDA, 1960). When linked to an irrigation control system, soil moisture sensors such as the Decagon 5TE™ are capable of maintaining soil moisture levels between the wilting point and a set value below the holding capacity. Assuming that typically at the onset of a storm event, the soil would be about halfway between the wilting point and the full holding capacity, the soil profile would be capable of storing about 0.75 inches of rainfall. This is a conservative estimate as water holding capacity of the 0.25' of mulch has not been included. Therefore, the soil profile will typically have the capacity to store or retain the 0.7 inches of rainfall occurring during the water quality design storm.

Runoff retained in the soil shall not leave the site via subdrains but shall be evaporated or transpired by vegetation. In this manner, the soil profile serves as a landscape level storage device for the stormwater quality design volume (SQDV). The water stored in the soil profile constitutes an adjustment to the SQDV calculated later in this report, and will not reach downstream treatment BMPs. BMPs have therefore been sized to treat only the runoff from impermeable surfaces on the site.

3.2 Pollutants and Hydrologic Conditions of Concern

The Newport Beach City Hall and Park Development Plan is a commercial development greater than 100,000 square feet (including parking area), and is designated as a Priority

Project according to the Orange County Drainage Area Management Plan (DAMP). Priority Projects are required to identify Pollutants of Concern and Hydrologic Conditions of Concern. These findings help to steer the development of the WQMP.

3.2.1 Pollutants of Concern

The Orange County Drainage Area Management Plan (DAMP) (Orange County, 2003) requires that potential pollution sources from the project area are identified and compared to downstream water quality conditions in order to determine "pollutants of concern" for the project. Pollutants of concern are those that are anticipated to be generated by the proposed project. Pollutants of concern are differentiated between primary and secondary depending on the condition of downstream receiving waters. If the project will drain to a receiving water that is impaired for a pollutant anticipated from that project, that pollutant is a primary pollutant of concern. Pollutants frequently identified on the 2006 303(d) list of California impaired water bodies include metals, nitrogen, nutrients, indicator bacteria, pesticides and trash (see 2006 303(d) List). In some cases, there may be specific conditions (i.e. other known water quality problems) that warrant identifying an anticipated pollutant as a primary pollutant of concern. If there is no corresponding impairment or other water quality problem in the receiving waters for an anticipated pollutant, the pollutant is a secondary pollutant of concern.

3.2.1.1 Existing Water Quality

No existing data on water quality within the wetland area was available at the time of writing. Due to the site's current natural character, it is not anticipated that the site contributes significant levels of pollutants to the watershed. Existing water quality issues include minor erosion within and along the western edge of the central parcel and along the western edge of the north parcel. During a site visit in April, 2009, it was observed that several drain inlets were unserviceable due to accumulation of sediment and organic debris. Due to new grading and site design, these drains inlets will be removed as part of the project.

Dry-weather flows from upstream residential areas enter the site at the east end of the wetland. These flows are anticipated to contain typical urban runoff pollutants, including bacteria and viruses, nutrients, pesticides, sediments, trash and debris, oxygen demanding substances, and oils and grease. Heavy metals and toxic organic compounds are likely to be present but in less significant concentrations. Recent flow data taken from the downstream end of the wetlands in June 2009 indicate that the dry weather flows are relatively constant at about 63 gallons per minute.

3.2.1.2 Project Pollution Sources

The first step in determining pollutants of concern, according to the methodology in the Model Water Quality Management Plan found in the DAMP (Orange County, 2003), is to identify potential project pollution sources. The project includes a number of land uses which will result in the occurrence of pollutants in stormwater runoff. These include office development, parking lots, streets, the dog park and other landscaped areas. Table 2 identifies the anticipated and potential pollutants generated by each land use. Table 2 is consistent with the methodology in the DAMP (Orange County, 2003) regarding identification of pollutants of concern.

Table 2: Anticipated and potential pollutants of concern generated by the project

General Pollutant Category	Land Use Category ¹				
	Commercial	Parking Lots	Street	Dog Park	Landscaping
Bacteria/Virus		P	P ⁴	X	
Heavy Metals	P	X	X		
Nutrients				X	P
Pesticides					P
Organic Compounds	P ²	X ³	X ³		
Sediments			X	X	P
Trash & Debris	X	X	⁵		
Oxygen Demanding Substances				X	P
Oil and Grease	X	X	X		

¹ Land use only corresponds to the building, or land use footprint. Associated landscaping associated with each land use is addressed separately in the Landscaping column

² Including solvents

³ Including petroleum hydrocarbons

⁴ Analysis of pavement runoff routinely exhibit bacterial indicators

⁵ Typically likely on public streets, but not likely within the City Hall setting

X = anticipated, P = potential

Landscape areas are typically included in broader land use categories. However, due to the extensive landscape areas for the project site, landscaping is treated as a separate category for the purposes of this WQMP. Soil amendments used for planting newly landscaped areas have the potential to introduce organic matter and nutrients to runoff. Treatment of landscaped area runoff will occur by promoting infiltration and storing water within the soil profile as described above in Section 3.1.3. This strategy is included along with other BMPs in the next section of this report.

3.2.1.3 Downstream Water Quality Conditions

The potential impacts of the water borne pollutants generated by the project and identified above in Section 3.2.1.2 depend upon the existing condition and impairments of the downstream receiving water body, Lower Newport Bay (The Bay). The Bay is in Hydrologic unit basin G as identified in Ocean Plan prepared by the State Water Resource Control Board (SWRCB). The Bay is listed on the 2006 303d list of Impaired Water Bodies for chlordane, copper, DDT, sediment toxicity, PCBs Metals, Nutrients, Pathogens, Pesticides/Priority Organics and Siltation. The listings carry the implication that the Bay has exceeded the maximum amounts of pollutants that it can receive while still meeting water quality standards. These maximum amounts are termed Total Maximum Daily Loads (TMDLs). The Federal Clean Water Act requires that programs aimed at reducing pollutant loading be implemented for all water bodies listed on the State 303d lists. These programs are also termed TMDLs. Ongoing TMDLs for The Bay are listed below.

- San Diego Creek/Newport Bay Toxics TMDLs

- San Diego Creek/Newport Bay Selenium TMDL
- San Diego Creek/Newport Bay Metals TMDL
- Newport Bay Fecal Coliform TMDL
- Newport Bay/San Diego Creek Nutrient TMDL
- Newport Bay/San Diego Creek Sediment TMDL

The set of TMDLs for The Bay are comprehensive in that they include a large variety of potential pollutants.

Based on the potential pollution sources from the project as well as the downstream conditions, Pollutants of Concern have been identified based on the criteria described in the DAMP (Orange County, 2003) and are provided in Table 3.

Table 3: Pollutants of Concern

Primary Pollutants of Concern	Secondary Pollutants of Concern
Bacteria/Virus ¹	Trash & Debris
Heavy Metals	Oxygen Demanding Substances
Nutrients	Oil and Grease
Pesticides	
Organic Compounds	
Sediments	

¹ Includes fecal coliform

3.2.2 Hydrologic Conditions of Concern

This section identifies hydrologic conditions of concern related to the proposed project. Hydrologic conditions of concern are identified through a review of on-site and downstream drainage paths. If the proposed project would cause or contribute flows to problems along on-site or downstream drainage paths, these problems or future problems are considered conditions of concern. Conditions of concern can include problems such as flooding, erosion, scour, and other impacts that can adversely affect channel and habitat integrity.

The only channels that receive runoff from the project site are the two fully natural reaches located on the project site between San Miguel Drive, MacArthur Blvd, and Avocado Avenue. The smaller channel runs north to south, is fed by runoff from the north parcel of the site and MacArthur Blvd north of San Miguel Drive, and joins the larger channel which runs east to west towards Avocado Ave. The larger channel receives runoff from a residential neighborhood area of approximately 75 acres as well as overland flow from the currently natural landscape within the project area. The channels are confined within a narrow flat area at the base of steep sided ravines and are densely vegetated by both wetland and riparian species. The slopes of the ravine are densely vegetated with intermittent areas of bare soil.

The channels were investigated during a site visit in April, 2009. With the exception of a small area of steep bank on the southern side of the larger channel, there was no evidence of erosion within these channels.

With the exception of new trails and the dog park, the areas of the site draining to the channels will remain largely as open space. However, whereas the open space is currently

natural vegetation, the future condition will consist of native or climate appropriate planting with small areas of meadow or drought tolerant lawn.

After entering the storm drain system at Avocado Ave, the drainage does not daylight until reaching Lower Newport Bay. Therefore, no additional hydrologic conditions of concern have been identified.

3.3 Drainage Report Summary

A drainage report has been prepared for the proposed project by Arup (Arup, 2009). The drainage report provides a summary of existing and future hydrologic conditions based on the current site plan. It provides recommendations for detention volumes or site plan alterations required to maintain peak flows and volumes at or below existing conditions. A summary of findings from the drainage report that are pertinent to this WQMP are provided in this section.

According to the drainage report, two detention facilities are required at the southwest and southeast corners of the site to manage increased peak runoff from the highly developed Civic Center region. They are sized to detain the volume of stormwater necessary to maintain or reduce peak discharge to points of connection to the City storm drain for events up to the 50-year storm event. The detention volume provided required for drainage area E is 1,600 cubic-feet (CF) and the volume for drainage area C is roughly 4,000 CF. As discussed later in this document, the detention requirements shall be combined with treatment BMPs in these drainage areas.

Stormwater generated by portions of San Miguel Drive and Avocado Avenue within drainage area Bv shall be added to the watershed of the larger wetland area. To reduce the total peak flows entering the wetland, runoff shall be diverted through vegetated swales with check dams along Avocado Ave. prior to entering the wetland. These shall serve both water quality and peak flow reduction purpose and are discussed later in this document. The check dams are sized to provide enough detention storage to reduce the peak flows to within 0.4% of existing conditions. The check dams generate a net-zero adjustment to the rate of peak discharge feeding the south wetland for all storm events.

Due to the shifting of the dog park watershed away from the smaller wetland to ensure no change in water quality entering the wetlands, the total volume of storm water entering the north wetland is reduced by approximately 11%. Because the existing wetlands are maintained by dry weather flows during the dry season, this is not likely to cause an impact to the their determining hydrologic characteristics.

3.4 Geotechnical Report Summary

A draft geotechnical report was prepared by Leighton Consulting for the project (Leighton Consulting, 2009). This section summarizes the findings of the geotechnical report relevant to the WQMP.

3.4.1 Bedrock

Based on the current project plan, the finish site grade will range from approximately 144 to 154 feet above mean sea level except where basement is planned, which will be at approximately 130 feet above mean sea level. It is anticipated that bedrock will be exposed within the majority of the site after grading.

3.4.2 Groundwater

Groundwater was encountered at approximately 45 to 67.2 feet below current ground surface during exploration. In general, the groundwater elevation is higher in the northern region of the site and gently slopes down towards the Central Library. Based on measurements from two groundwater monitoring wells south of the ravine, the water level has been fairly constant throughout the 3-month period after the field exploration. Groundwater is not anticipated to be encountered during excavation in most of the areas. Groundwater may be encountered during the excavation for the basement.

3.4.3 Percolation

A single percolation test was performed within boring NB-7. The percolation test was performed at a depth of approximately 37 feet below current grade (Elevation 125 feet mean sea level). Bedrock of Monterey formation was exposed at the bottom of the percolation test hole. The results of the test indicated that the bedrock at the tested depth has a percolation rate of less than 0.02 gallon per square foot per day or 0.032 inches per day. This rate of infiltration is negligible compared to rainfall depths of 0.7 inches for the water quality design storm.. Therefore, on-site infiltration is not feasible. Further percolation tests may be performed after grading to determine if targeted areas at the site are suitable for on-site infiltration.

4 Best Management Practices

The Newport Beach City Hall and Park Development is a Priority Project and is therefore, per the DAMP (Orange County, 2003), required to incorporate and implement Source Control BMPs (routine structural and routine non-structural), Site Design BMPs, and Treatment Control BMPs to the extent that they are applicable to the project. The strategy consists of: 1) reducing post-project runoff; 2) controlling sources of pollutants; 3) retaining WQE runoff on-site through infiltration, evapotranspiration or reuse, and 4) treating stormwater runoff before discharging it to the storm drain system or to receiving waters. Because the design shall meet the on-site treatment terms of the MS4 permit, the project will not participate in regional or watershed based programs in order to meet water quality targets. These programs are only required if on-site treatment is not feasible.

In accordance with the current Orange County DAMP (Orange County, 2003) and consistent with the recently adopted MS4 Permit R8-2009-0030, low impact development (LID) features have been included in the site design to reduce runoff as well as provide treatment of storm water runoff from the project. These features include preventative measures, such as site design and source control BMPs, and mitigation measures such as treatment control BMPs, which include the use of infiltration at natural rates, bioswales, and bioretention features to mimic infiltration processes to the maximum extent practicable (MEP) based on existing soil, drainage, and on site constraints. Due to the low infiltration rates of the native soils and presence of bedrock, direct infiltration of storm water runoff is not feasible for the site. However, the proposed swales, bioswales, bioretention and detention basins will be unlined to allow for infiltration at natural rates, while containing subdrains to allow excess treated water that does not infiltrate to drain off-site to minimize excess ponding and vector concerns. In addition, the majority of treatment BMPs will be designed utilizing bio-treatment methods which mimic natural treatment processes with filtration layers thereby providing a higher level of treatment that is consistent with the concepts of LID. In addition, this project proposes incorporating the LID harvest and reuse component as described elsewhere in his WQMP (refer to treatment control TC-12).

4.1 Site Design BMPs

Site design BMPs are those BMPs that reduce runoff or pollutants at the source through intentional use of landforms and materials. This section describes design elements of the project which will improve stormwater management at the site through the use of site design BMPs. The following BMPs have been incorporated into the project.

4.1.1 SITE DESIGN CONCEPT 1: Minimize Stormwater Runoff, minimize project impervious footprint and conserve natural areas

SD 1.1	Maximize permeable area: With a few necessary exceptions, the majority of open spaces within the site have been designed to be permeable. Parking has been predominantly incorporated into a 3 story parking structure rather than spread as surface parking over the site. Approximately 61% of the 17.6 acre site will have a permeable surface.
SD 1.2	Conservation of natural areas: The majority of existing valuable native habitats lies within the northern half of the south parcel and include the existing wetlands and upland coastal scrub vegetation. The wetland area, along with the upland vegetation within the steep ravine (slopes greater than 1:1) will remain as is with the exception of 8-foot wide trails that will descend the ravine and cross the wetlands at three locations. While the remaining upland areas adjacent to the wetlands will be largely re-graded to provide accessibility and park use areas adjacent to trails, they will be re-vegetated with native or adapted drought tolerant vegetation over approximately 60% of their area. The remaining 40% shall consist of level fields, vegetated with drought tolerant turf for recreational purposes.
SD 1.3	Use of permeable paving or other surfaces: Permeable asphalt which meets ADA requirements can have high maintenance requirements in order to maintain permeability over the life of the project. Footpaths in the park areas, surface parking and terraces adjacent to the buildings shall not be constructed of permeable materials. Due to the limited availability of surface parking, it is anticipated that these areas will receive high usage. The use of a permeable material at the dog park shall be precluded by the need to line the sub-grade in order that all runoff from the dog park receives adequate treatment.
SD 1.4	Designing to minimum widths necessary: Streets, sidewalks and parking lot aisles will be designed to the minimum widths necessary, while complying with ADA regulations and other life safety requirements. Park paths shall be eight (8) feet in width, maximum.
SD 1.5	Incorporation of landscaped buffers: Along roadways within the project area, incorporation of landscaped buffer areas between sidewalks and streets will be provided where accessibility and topography constraints are permitting. Landscape buffers occur extensively along the southern access roadway and loading dock access roadway and to a lesser extent along the main entrance way roadway.
SD 1.6	Reduced street widths: Street widths within the project area are set to minimums required by the City of Newport Beach, in compliance with life safety requirements for fire and emergency vehicle access. Streets are designed for 12-foot traffic lanes. The San Miguel Drive enhancement may incorporate reduced lane widths.
SD 1.7	Maximize canopy interception: As previously described, the majority of open spaces shall be planted with either native or adapted drought tolerant vegetation. Exceptions are the civic

	green, level areas within the open spaces, trails, pavilions, and the terraces/gardens immediately adjacent to the buildings.
SD 1.8	Use of native or drought tolerant trees/shrubs: Vegetation in the wetland and the adjacent steep slopes (> 1:1) will be preserved. Other pervious areas of the northern half of the central parcel and the north parcel as well as the western edge of the site adjacent to MacArthur Boulevard shall be planted with drought tolerant trees/shrubs/groundcover/grasses.
SD 1.9	Minimizing impervious surfaces in landscaping: Roadways and trails are set to minimum widths and lengths, as practicable to comply with ADA standards.
SD 1.10	Use of natural drainage systems: The project will use at grade drainage systems such as vegetated drainage swales or naturalized channels to convey runoff from most areas of the site. Drainage swales may be designed differently than treatment swales in that they will not be sized to treat runoff from the WQE but rather to convey runoff from larger storm events. To promote infiltration at natural rates, at grade drainages will be surfaced with pervious material. While at grade drainages sometimes provide water quality treatment, the majority of at grade drainages will terminate at Treatment BMPs. These shall be specifically designed for treatment purposes and are described later in this report in Section 4.3.
SD 1.11	Low flow infiltration: Perforated pipes shall be used for secondary landscaped drains in locations where soils are suitable for infiltration. The primary storm drains, such as the drain which runs north to south beneath the civic green, will carry higher flows and will not be perforated. Perforated subdrains shall also be used beneath treatment BMPs including vegetated swales and detention basins. This shall improve treatment by filtering runoff as it percolates through the soil profile to the subdrains.

4.1.2 SITE DESIGN CONCEPT 2: Minimize Directly Connected Impervious Areas (DCIAs)

SD 2.1	Draining rooftops into adjacent landscaping: Runoff from the parking structure and the City Hall building shall drain to an extended detention basin behind the Library in drainage area Ci and runoff from the new Library Extension roof shall drain to detention basins in drainage areas Ciii and Eii. These BMPs shall provide treatment as well as promote infiltration and absorption of water into the soil profile. Utilizing these BMPs as pre-treatment devices for a rainwater harvesting system is being considered. See TC-12 in Table 6 for further information regarding rainwater harvesting.
SD 2.2	Draining to adjacent landscaping: The majority of pathways and trails throughout the site are flanked by open space. Runoff from pathways shall sheet flow into adjacent open space where it will be picked up by either vegetated swales, vegetated filter strips or extended detention basins.
SD 2.3	Vegetated drainage swales: Vegetated drainage swales shall be implemented in lieu of subsurface drainage pipes to the maximum extent practicable. Subsurface drainage pipes or surface slot drains are only used at the site where spatial constraints or slopes prohibit their use. In some instances, subsurface landscape drains need to discharge to subsurface drainages. In contrast to treatment swales, which are designed specifically to provide treatment, vegetated drainage swales are sized for conveyance of large storm event runoff. The drainage swales in most cases will discharge into treatment BMPs.

- SD **Site drainage system:** The site drainage design incorporates several methods for conveying street and parking area runoff to BMPs. At the main entrance roadway and the loading bay area, runoff will drain to a curb cut which opens into either a vegetated swale or bio-retention basin. At the southern access road, runoff will sheet flow to a vegetated drainage swale leading to a bioretention basin. Runoff from the southern at grade parking area and the civic green will drain directly to subsurface storm drains. WQE flows in drainage area Ci will be routed away from this storm drain to a detention basin behind the library building. Runoff from the covered part of the parking structure shall drain to a clarifier and subsequently the sewer, which is consistent with other parking structures within the City. Runoff from the at-grade parking area in the north parcel along Avocado Ave. will drain through a curb cut to treatment swales which discharge to a subsurface drain and finally to a detention basin. All open space runoff will sheet flow to the nearest drainage or treatment device.

4.2 Source Control BMPs

Source control BMPs, both routine non-structural and routine structural, are discussed in this section. Source Control BMPs are measures focusing on reducing or eliminating post-project runoff and controlling sources of pollutants. Source Control BMPs can be represented in non-structure measures such as requirements, cleaning, education, and maintenance or structural measures such as landscape, irrigation, signage considerations, materials, and design of areas. Routine non-structural and routine structural BMPs are described and discussed in the context of the project in Table 4.

Table 4: Routine non-structural BMPs

Number	BMP and Objective	Included
<i>(numbers correspond to those in the Orange County DAMP Exhibit A-7. IV)</i>		
N1	<p>Education for Property Owners, Tenants and Occupants: Practical informational materials are provided to residents, occupants, or tenants to increase the public's understanding of stormwater quality, sources of pollutants, and what they can do to reduce pollutants in stormwater.</p> <p>Explanation/Description: Upon occupying the building, the city will maintain educational materials regarding the layout, structure, management, and maintenance of the stormwater system. This shall include details for management and upkeep of specific areas including the loading dock, dog park, parking structure and general landscaping. The educational material shall include the types and uses of all chemicals to be used at the site including solvents, pesticides, fertilizers, and detergents.</p>	YES
N2	<p>Activity Restrictions: Rules or guidelines for developments are established within appropriate documents (i.e. CC&Rs, lease terms, etc.) which prohibit activities that can result in discharges of pollutants.</p> <p>Explanation/Description: Activity restriction shall be implemented at the site to reduce the risk of pollutants from entering the storm drains. These shall include and not be limited to prohibitions for on-site storage of fertilizers and pesticides, dumping of cleaning water or other wastes and</p>	YES

	chemicals into the storm drain, overwatering of landscape areas, washdown of impermeable landscape areas using other than high pressure and low water use jet spray nozzles, maintenance vehicle washing, and a requirement for pet owners to remove pet feces.	
N3	<p>Common Area Landscape Management: Specific practices are followed and ongoing maintenance is conducted to minimize erosion and over-irrigation, conserve water, and reduce pesticide and fertilizer applications.</p> <p>Explanation/Description: A landscape management crew, employed by the City, shall be responsible for maintaining landscapes in the open space around the site. In particular, the landscape crew shall be instructed to remedy any erosion or irrigation systems leaks as they occur.</p> <p>Permanent irrigation will be required at the more formalized landscaped areas. Where feasible, micro-irrigation systems shall be installed to minimize water use and reduce the chance of over-watering. Micro-irrigation systems utilize small water emitters either just above or below the ground surface. Spray irrigation may be required to maintain healthy vegetation in targeted areas such as the civic green. Native or climate adapted vegetation in the less formal landscaping areas will receive irrigation during a plant establishment period.</p>	YES
N4	<p>BMP Maintenance: In order to ensure adequate and comprehensive BMP implementation, all responsible parties are identified for implementing all non-structural BMPs and for structural BMPs, cleaning, inspection, and other maintenance activities are specified including responsible parties for conducting such activities.</p> <p>Explanation/Description: The City shall be responsible for all maintenance activities associated with the stormwater management BMPs, both structural and non-structural. The City shall identify an appropriate staff member, such as the facilities manager, to inspect and organize the periodic maintenance of BMPs. Routine and periodic maintenance activities such as debris and sediment removal shall be conducted by the City's landscape maintenance crew. Non-routine maintenance such as major reconstruction or replacement shall be handled by contractors with experience in constructing stormwater management BMPs.</p>	YES
N5	<p>Title 22 CCR Compliance: Hazardous waste is managed properly through compliance with applicable Title 22 regulations.</p> <p>Explanation/Description: The project includes a fuel storage facility area for a backup generator. The fuel storage area and facilities shall comply with relevant sections of Title 22 of the California Code of Regulations as well as relevant sections of the California Health and Safety Code. For example, storage areas shall be paved and sufficiently impervious to contain leaks and spills and be covered with a roof or awning to minimize collection of storm water within the secondary containment area.</p> <p>It is not anticipated that other hazardous wastes will be handled at the City Hall facility. The building cooling system will not utilize chemicals but shall implement a chemical free cooling tower system. Wastewater treatment systems for on-site reuse, if implemented, shall utilize non-chemical</p>	YES

	<p>disinfection methods such as UV or Mixed Oxidant disinfection.</p> <p>Pesticides for landscape management would be stored off-site at the City's maintenance yard.</p>	
N6	<p>Local Water Quality Permit Compliance: The project complies with Permits issues under the Water Quality Ordinance to ensure clean stormwater discharges from fuel dispensing areas and other areas of concern on public properties.</p> <p>Explanation/Description: The project does not include fuel dispensing areas or other areas of concern on public properties. Therefore this BMP does not apply to the project.</p>	NO
N7	<p>Spill Contingency Plan: A spill contingency plan is prepared for any hazardous chemicals or materials handled at the site.</p> <p>Explanation/Description: The project includes a fuel storage facility area for a backup generator. A spill contingency plan shall be prepared by the City to safeguard the site in the event of an accidental fuel spill. Copies of the plan shall be clearly marked and reside with the site manager as well as at a convenient location within the fuel storage area. The plan shall mandate stockpiling of cleanup materials and implements, notification of responsible agencies, disposal methods of cleanup materials, and documentation of cleanup actions and spill quantities.</p>	YES
N8	<p>Underground Storage Tank Compliance: The project does not include underground storage tanks and is therefore not required to comply with appropriate policies and regulations.</p>	NO
N9	<p>Hazardous Materials Disclosure Compliance: Measures shall be taken to comply with applicable local, state, and federal regulation to avoid harm to humans and the environment from the handling and storage of hazardous materials or wastes.</p> <p>Explanation/Description: The project includes a fuel storage facility area for a backup generator. Because hazardous materials will be handled at the site, measures shall be taken to comply with requirements of the local fire department, health care agency, and other appropriate agencies including the Department of Toxic Substances Control.</p>	YES
N10	<p>Uniform Fire Code Implementation: The project shall comply with Article 80 of the Uniform Fire Code regarding hazardous material storage facilities.</p> <p>Explanation/Description: The project includes a fuel storage facility area for a backup generator. Design installation and operation of this facility shall comply with elements of Article 80 of the Uniform Fire Code. For example, according to Article 8004.2.2.5, rooms or areas where hazardous material liquids are dispensed into containers exceeding a 1-gallon (3.785 L) capacity or used in open containers or systems exceeding a 5-gallon (18.93 L) capacity shall be provided with spill control. Secondary containment shall be provided when the capacity of an individual container exceeds 55 gallons (208.2 L) or the aggregate capacity of multiple containers exceeds 100 gallons (378.5 L).</p>	YES

	<p>Article 8003.1.7.2 states that floors shall be sloped; constructed with sumps and collection systems; recessed a minimum of 4 inches; provided with a liquid-tight raised sill to a minimum height of 4-inches to prevent the flow of liquids to adjoining areas; or otherwise constructed to contain a spill from the largest single container or tank. Except for surfacing, the sill shall be constructed of noncombustible material, and the liquid-tight seal shall be compatible with the material stored. When liquid-tight sills are provided, they are not required at door openings which are provided with and open-grate trench that connects to an approved drainage system.</p>	
N11	<p>Common Area Litter Control: Trash management and litter control procedures are specified, including responsible parties, and implemented to reduce pollution of drainage water.</p> <p>Explanation/Description: An appropriate City employee, such as the facilities manager, shall be responsible for ensuring that the premises remain clear of trash and large debris such that risk of pollution to receiving waters is minimized. The facilities manager may appoint this task to a landscape maintenance contractor. Garbage bins and cigarette disposal devices shall be placed in sufficient numbers throughout the open space trail network and around City Hall and parking structure buildings to encourage safe disposal of trash and litter by visitors and employees. The landscape contractor or City staff in charge of this responsibility shall undertake routine litter patrols, including inspection and emptying of trash receptacles, and noting and recurring violations.</p>	YES
N12	<p>Employee Training: Practical informational materials and/or training are provided to employees to increase their understanding of stormwater quality, sources of pollutants, and their responsibility for reducing pollutants in stormwater. Copies of operation and maintenance manuals and specifications as available for all BMPs used must be included in Appendix A of the WQMP.</p> <p>Explanation/Description: City Hall staff does receive annual stormwater training. However, training shall be provided for targeted staff in the position to affect stormwater quality. In particular, kitchen staff shall be educated on the proper disposal of kitchen cleaning liquids, dirty water, and food waste including oils and greases. Site maintenance staff shall be similarly trained in the uses and appropriate disposal methods of cleaning and maintenance materials.</p>	YES
N13	<p>Housekeeping of Loading Docks: Cleaning and clean up procedures are specified and implemented for loading dock areas to keep the area free for pollutants and reduce associated pollutant discharges.</p> <p>Explanation/Description: The loading dock at the City Hall will receive relatively few deliveries compared to other types of commercial facilities. Deliveries at City hall shall include food items and other supplies. The loading dock shall be regularly swept and kept clear of clutter, debris and trash. Should any breakage or spill occur, cleanup shall be undertaken immediately without the use of water whenever possible. Any water used in cleanup activities will be discharged to the sanitary sewer. Appropriate permits shall be sought for this connection. Vehicle washing shall be prohibited at the loading dock area.</p>	YES

N14	<p>Drainage Facility Inspection: Inspection procedures, schedules, and responsibilities are established for drainage facilities to ensure regular cleaning, inspection, and maintenance.</p> <p>Explanation/Description: The City maintenance staff shall inspect all catch basins (drain inlets), stormwater BMPs, pumps if applicable, storm drain cleanouts, and drainage swales at least once per year – typically in late summer or early fall prior to the start of the wet season. An inspection log shall be kept with the facilities manager. At least 80% of all drainage facilities shall be cleaned and maintained on an annual basis, with 100% of the facilities included in a two-year period. Inspection and cleaning shall take place in late summer to early fall prior to the start of the rainy season.</p>	YES
N15	<p>Street Sweeping Private Streets and Parking Lots: Street sweeping frequency and responsible parties are identified and regular sweeping is conducted to reduce pollution of drainage water.</p> <p>Explanation/Description: All streets and parking areas on site shall be swept using appropriate street cleaning equipment on a weekly basis.</p>	YES
N17	<p>Retail Gasoline Outlets: Specific operational and maintenance BMPs are implemented to the extent feasible to reduce potential for pollutant discharge from wash off by runoff, leaks, and spills.</p> <p>Explanation/Description: There are no gasoline outlets on the site.</p>	NO

Table 5: Routine structural BMPs

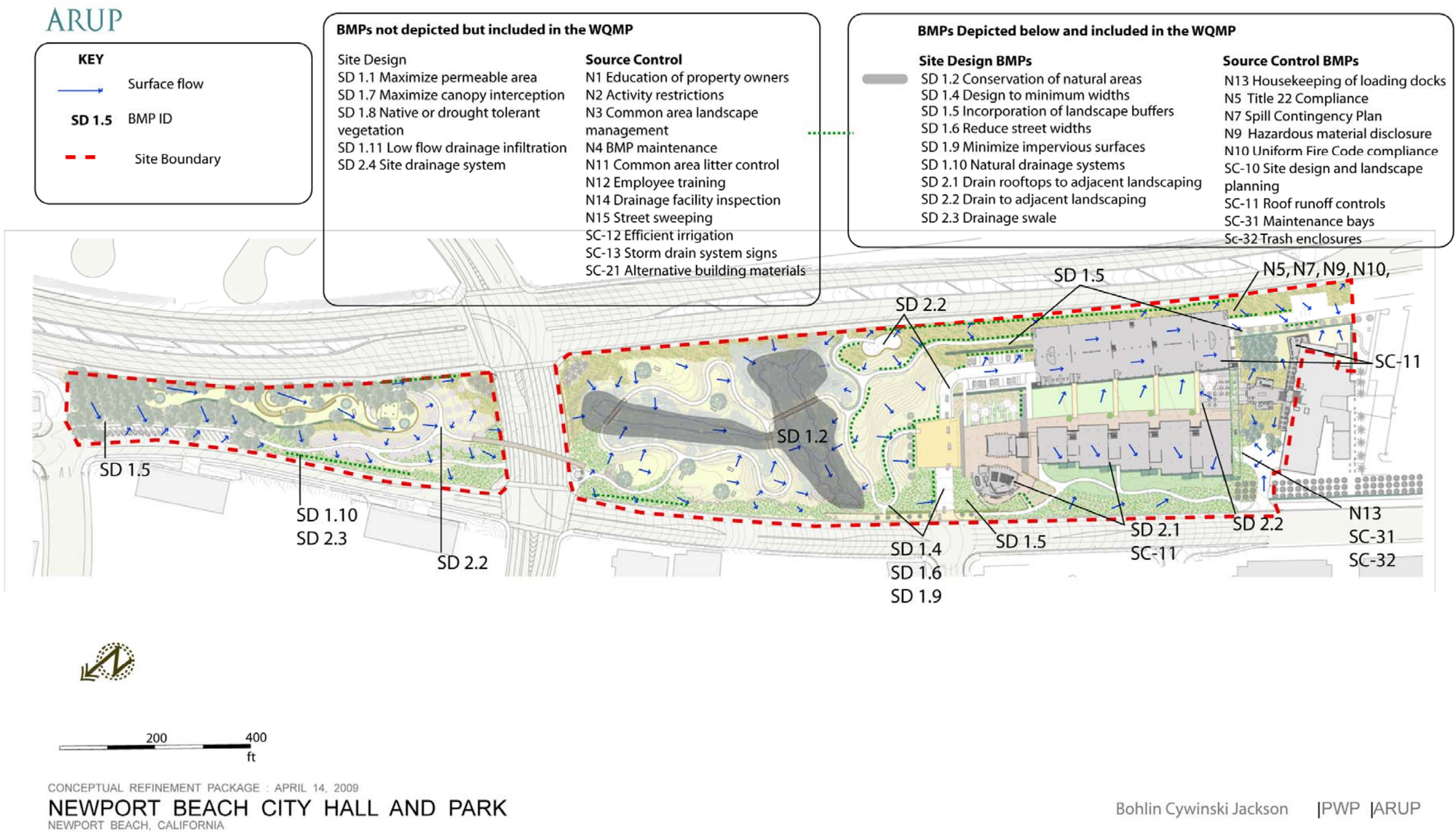
Number	BMP and Objective	Included
<i>(numbers correspond to those in the CASQA's BMP Handbook for New Development & Redevelopment)</i>		
SC-10	<p>Site Design and Landscape Planning: Landscape planning methodologies are incorporated into project design to maximize water storage and infiltration opportunities and minimize surface and groundwater contamination from stormwater.</p> <p>Explanation/Description: Site design and landscape planning shall incorporate water storage and infiltration opportunities consistent with the LID approach to stormwater management. These include drainage swales with check dams constructed from stone or similar materials. Drainage swales may vary in typology, ranging from fully vegetated linear depressions where flows are minimal in the upper drainage areas to naturalized channels with rock bottoms where larger flows will occur in lower drainage areas. Landscape drainage features will terminate in Treatment BMPs designed to standards set forth in the DAMP.</p>	YES
SC-11	<p>Roof Runoff Controls: Direct roof runoff away from paved areas and to pervious areas, cisterns, infiltration trenches, and/or storage areas for reuse to reduce total volume and rate natural infiltration rates at the site.</p> <p>Explanation/Description: Roof runoff from the City Hall, Council Chambers, Library Expansion and parking structure buildings shall be diverted to naturalized treatment BMPs where infiltration and absorption of moisture into the soil layers will occur. City Hall and Council Chamber runoff will flow to a vegetated swale with check dams on the west side of the City Hall Building. Library Expansion and parking structure WQE</p>	YES

	<p>runoff will flow to an extended detention basin on the North side of the Library.</p> <p>One or more sub-surface vaults shall be installed to receive runoff from all building roofs as well as open spaces around the buildings to mitigate anticipated increases in peak discharge from the site. Water from the vaults may be treated and reused on site for non-potable uses.</p>	
SC-12	<p>Efficient Irrigation: Project plans include application methods to minimize irrigation water discharged into stormwater drainage systems.</p> <p>Explanation/Description: Site-wide irrigation shall be automated and use soil moisture sensors and timers or an equivalent technology to dictate when irrigation is applied. Moisture sensors will, on a daily basis, activate the irrigation system. Timers will ensure that when irrigation is required it is only applied during mornings or evenings when evapotranspiration losses are at a minimum. The application method shall be designed to minimize the runoff of excess irrigation water into the municipal storm drain. Where feasible, micro-irrigation systems shall be installed to minimize water use and reduce the chance of over-watering. Micro-irrigation systems utilize small water emitters either just above or below the ground surface and directed at plant root systems. Spray irrigation may be required to maintain healthy vegetation in targeted areas such as the civic green. Native vegetation in the less formal landscaping areas will receive irrigation during the plant establishment period. Mulches shall be used at the surface in landscaped areas to minimize sediment in runoff. Flow reducers or shutoff valves triggered by pressure drops shall be installed to control water losses from broken emitters or lines.</p>	YES
SC-13	<p>Storm Drain System Signs: Stencils or affixed signs a placed adjacent to storm drain inlets to prevent waste dumping.</p> <p>Explanation/Description: All storm drain inlets shall be marked with stencils indicating that the drain leads to Newport Bay and forbidding dumping of pollutants.</p>	YES
SC-20	<p>Pervious Pavements: Porous concrete or asphalt, blocks with pervious spaces or joints, or grass or gravel surfaces are employed to reduce runoff volume and provides treatment.</p> <p>Explanation/Description: All trails, pathways and paved areas shall be ADA compliant and shall therefore require smooth surfaces. While pervious asphalt has been considered as a potential material for these surfaces, long term maintenance by surface vacuuming is required to maintain the materials function. Therefore, pervious pavements shall not be used at the site. Other mechanisms consistent with an LID stormwater management approach for encouraging natural infiltration and treatment have been incorporated into the design to manage runoff from these areas.</p>	NO

SC-21	<p>Alternative Building Materials: Specialized building materials are employed that have lower potential to leach pollutants, and reduce need for future painting or other pollutant generating maintenance activities. For example, some treated wood contains pollutants that can leach out to the environment and some metal roofs and roofing materials result in high metal content in runoff.</p> <p>Explanation/Description: Building materials have not been specified. However, care shall be taken to minimize the use of materials which cause leaching of pollutants or which require frequent pollutant generating activities such as cleaning.</p>	YES
SC-30	<p>Fueling Areas: Project plans are developed for cleaning, spill cleanup, containment, leak prevention, and incorporation of design to reduce rain and runoff that could come in contact with fueling areas.</p> <p>Explanation/Description: There are no fueling areas on the site</p>	NO
SC-31	<p>Maintenance Bays and Docks: Project design incorporates measures to cover or otherwise eliminate run-on and off from bays and docks, and direct connections to storm drain are eliminated.</p> <p>Explanation/Description: The loading dock doorway shall be covered by a high overhang of the buildings roof. Additionally, the ground shall slope gradually away from the building in the immediate vicinity of the loading area. This combination of design measures shall prevent stormwater run-on to the loading area.</p> <p>To prevent runoff of water from the loading bay, a concrete drainage channel with metal grates shall be placed around its perimeter. The channel shall lead to the sanitary sewer.</p>	YES
SC-32	<p>Trash Enclosures: Trash storage areas are covered and enclosed to prevent introduction of trash and debris to site runoff.</p> <p>Explanation/Description: The trash storage area shall be located at the rear of the City Hall building adjacent to the loading bay. Some trash receptacles will be located within the building. Areas outside of the building used for trash storage shall be covered and slightly elevated to prevent the introduction of trash, debris and other pollutants to site runoff.</p>	YES
SC-33	<p>Vehicle and Equipment Washing Areas: Designated wash areas or facilities are contained and wash water is reused, treated, or otherwise properly disposed of.</p> <p>Explanation/Description: Vehicle and equipment washing areas are not included in the site design.</p>	NO
SC-34	<p>Outdoor Material Storage Areas: Outdoor storage areas for materials containing pollutants, especially hazardous materials, are covered and enclosed, on impervious surfaces, and include secondary containment when applicable.</p> <p>Explanation/Description: Outdoor material storage areas are not included in the design.</p>	NO

SC-35	<p>Outdoor Work Areas: Outdoor work areas are covered, contained, and treated as necessary to reduce opportunity of pollutants from work activities to enter stormwater.</p> <p>Explanation/Description: Outdoor work areas are not included in the design.</p>	NO
SC-36	<p>Outdoor Processing Areas: Outdoor processing areas are covered, contained, and treated as necessary to reduce opportunity of pollutants from work activities to enter stormwater.</p> <p>Explanation/Description: Outdoor processing areas are not included in the design.</p>	NO

Figure 5: Site design and source control BMPs



4.3 Treatment BMPs

Treatment BMPs utilize treatment mechanisms to remove pollutants that have entered stormwater runoff and consist of public domain BMPs (identified in the following table as TC-##) and manufactured or proprietary BMPs (identified in the following table as MP-##). BMP numbers correspond to the CASQA BMP Handbook. The primary goal of these devices is water quality improvement, and selection of any device requires that it is feasible to implement and effective for pollutants of concern. Other selection criteria have been considered for the project. These include ease of maintenance and cost of implementation.

Table 6 identifies the treatment control BMPs considered for or included in the proposed project. Several of the treatment control BMPs proposed for the project are also considered low impact development (LID) features. The goal of using LID features is to mimic the site's existing hydrology by using design measures that capture, filter, store, evaporate, detain and infiltrate runoff, rather than allowing runoff to flow directly to piped or impervious systems. This includes directing runoff to vegetated areas, protecting native vegetation, and reducing the amount of impervious surfaces. These features include the use of bioswales with check dams, dry detention basins or bioretention basins, and vegetated filter strips throughout the site. Figure 10 indicates the locations, contributing watersheds and relative sizes of the identified treatment BMPs.

The Geotechnical Report indicated that the percolation rate of the underlying bedrock is 0.032 in/day. This minimal infiltration capability is a driving factor in choosing and designing treatment BMPs. Lining of BMP treatment devices may be necessary to prevent saturation of the ground in the constructed portion of the site in the south. Saturated soils may lead to undesired effects such as water seepage into basements and foundation issues.

The final design of this system may change slightly from the concepts described and depicted here. However, the overall function and results will remain fundamentally the same. For example, a detention basin may, in the future, be split into two or more parts located in different parts of a drainage area. In other instances, a vegetated swale with check dams may be replaced by a single bio-retention basin. These alterations, should they be made, shall intend to improve upon rather than reduce from the integrity of the water treatment strategy.

Table 6: BMPs considered for or included in the project

Number	BMP and Objective	Included
INFILTRATION		
TC-10	<p>Infiltration Trench: A long narrow rock filled trench with no outlet receives water and stores it until it infiltrates into the underlying soil. It is effective at removing most pollutants but can get clogged with sediment.</p> <p>Explanation/Description: Infiltration trenches shall not be used on site for the following reasons. Soils are generally not suitable for direct infiltration, grading shall take much of the site ground surface to the level of bedrock, and infiltration trenches tend to require more intensive maintenance than other devices with similar water quality improvement performance.</p>	NO

TC-11	<p>Infiltration Basin: A shallow impoundment designed to capture and hold stormwater until it infiltrates into underlying soil. Effective at removing most pollutants but requires large areas and may be constrained by soil types.</p> <p>Explanation/Description: See TC-10. The devices at the site will not be specifically designed for infiltration but will be open bottom and allow infiltration to occur at natural rates.</p>	NO
TC-12	<p>Retention/Irrigation: Stormwater is captured in cistern, basin, trench, or other storage area and is subsequently used for irrigation of site landscaping.</p> <p>Explanation/Description: Rainwater harvesting from building roofs and landscaped areas is currently being considered as a means for meeting water quality targets. Captured water may be reused on site for a combination of indoor and outdoor non-potable uses.</p> <p>Under the optional rainwater harvesting plan, the dry detention basins for drainage areas Ci, Cii, Ei, Eii, and Eiii shall have perforated stand pipes which drain to a subsurface rainwater storage tank. The entire or a portion of the SQDV (~10,400 cubic feet) from these drainage areas shall be stored in the tank for preceding further treatment and reuse. The detention basins in drainage areas Ci, Ei, Eii, and Eiii are currently sized retain the SQDV and drain this volume over a period of 48 hours through a perforated stand pipe. This retention provides initial removal of solids and is an effective pretreatment step for the reuse system.</p> <p>As discussed in Section 3.1.3 soils in open spaces will be enhanced to improve infiltration and absorption compared to typical open space. The soil profile shall serve as a broad scale storage volume for the SQDV from open space areas and will eliminate runoff from open space during the water quality design storm. The water stored in the soil profile will be “reused” by vegetation in the landscaped areas.</p>	YES
DETENTION AND SETTLING		
TC-20	<p>Wet Pond: A constructed basin with a permanent pool of water throughout the year. Differ from wetlands because it is of greater depth. Treats stormwater runoff by settling and biological uptake.</p> <p>Explanation/Description: A wet pond is not appropriate at the site due to the lack of a permanent water source to maintain water within the permanent pool.</p>	NO
TC-21	<p>Constructed Wetland: A constructed basin with permanent pool of shallow water throughout most of year with substantial vegetative coverage.</p> <p>Explanation/Description: A constructed wetland is not appropriate at the site due to the lack of a permanent water source to maintain water within the shallow permanent pool.</p>	NO

TC-22	<p>Extended Detention Basin: A constructed basin with an outlet designed to detain stormwater for at least 48 hours to allow particles and pollutants to settle.</p> <p>Explanation/Description: Small extended detention basins shall be used to detain water from a number of locations at the site including drainage areas Aiv (the dog park), Ci, Ciii, Di, Ei, Eii, and Eiii. These shall be very similar to bioretention basins but shall likely require the use of liners to prevent subsurface ponding in the vicinity of the library basement. Bio-retention basins are not typically lined and utilize natural infiltration to disperse stored water. A perforated stand pipe shall allow the basins to drain over a period of 48 hours and may lead to a water reuse storage tank. A separate overflow drain for larger storm events will bypass the water reuse tank and flow directly to the storm drain.</p> <p>The detention basins in drainage areas Ci, Ei, Eii, and Eiii will also attenuate peak flows during larger storm events by providing additional storage above and beyond the SQDV. The required volumes for additional storage, as indicated in the Drainage Report prepared by Arup, are estimated to be 4000 and 1600 cubic feet respectively for drainage areas C and E.</p> <p>The extended detention basins shall be planted with ground cover and /or larger vegetation depending on the site specific landscape design intent. The type of vegetation planted will dictate the depth of the soil profile and thus the depth of the impervious liner. Extended detention strategies shall be used to treat runoff from, among other areas, the dog park, the main entrance road, the rear entrance road, the parking structure, the civic green, and the roof of the library expansion.</p> <p>Effluent from the extended detention basin serving the dog park shall discharge to the vegetated swales within sub-drainage area Aiv. This detention basin may be replaced by a media filter as described below in TC-40.</p> <p>Specific locations and sizing information are provided in Figure 10 and Table 9.</p>	YES
MP-20	<p>Wetland: Similar to a constructed wetland but a self contained, manufactured module with vegetation that mimics natural wetland processes.</p> <p>Explanation/Description: A wetland is not appropriate at the site due to the lack of a permanent water source to maintain water within the shallow permanent pool. While storing and treating over time is a possibility, this option carries higher costs than other treatment BMPs. Furthermore, package wetland systems can require significant maintenance.</p>	NO
BIOFILTRATION		

TC-30	<p>Vegetated Swale: Open, shallow, vegetated channels that collect and slowly convey runoff through the property. Filters runoff through vegetation, subsoil matrix, and/or underlying soils; traps pollutants, promotes infiltration and reduce flow velocity.</p> <p>Explanation/Description: Vegetated swales shall be used extensively at the site. The vegetated swales shall in most instances be modified with check dams to reduce the occurrence of short circuiting flows. Check dams have will be approximately 3 inches in height. The swales shall provide both biofiltration, as is typical of vegetated swales, and retention of WQE runoff through infiltration and absorption within the soil profile. The vegetated treatment swales shall have a subdrain where native soils are impervious as is typical on the majority of the site Utilizing the subdrain will ensure that runoff is filtered through the soil profile before being discharged to a storm drain. Detailed sizing calculations have been made to ensure that the entire water quality volume can be infiltrated through the soil profile at a long term rate of 0.9 inches per hour.</p> <p>The vegetated swales shall receive runoff from numerous open spaces. The dog park runoff shall also pass through a vegetated swale after being detained in an extended detention basin. Specific locations and sizing information for vegetated swales are provided in Figure 10 and Table 8.</p>	YES
TC-31	<p>Vegetated Buffer Strip: Vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. Removes pollutants by deceleration, settling, and infiltration.</p> <p>Explanation/Description: Vegetated buffer strips are included as specific treatment devices within the watersheds that contribute sheet flow directly to the existing wetlands. The vegetated buffer strip shall form a treatment barrier surrounding the wetland such that any landscape drainage crosses the filter prior to sheet flowing to the wetland. This shall reduce flows by infiltration and improve water quality.</p> <p>In addition, some runoff from pathways, terraced areas and other spaces will, by necessity, sheet flow across vegetated areas prior to reaching conveyance or treatment devices. While not the primary treatment mechanism in this instance, the additional treatment is similar to that described in the site design BMP section under SD 2.2.</p>	YES
TC-32	<p>Bioretention: A soil and plant based filtration strategy that involves capturing stormwater in depressed landscaped areas. Bioretention practices are flexible strategies for using landscaping as treatment.</p> <p>Explanation/Description:</p> <p>As described in the extended detention basin and vegetated swales discussion (see above BMP TC-22 and TC-30) the intended design of extended detention basins and vegetated</p>	YES

	swales shall be very similar to bioretention basins but with perforated subdrains or stand pipes employed rather than relying solely on natural infiltration. However, in some instances it may be determined that localized natural infiltration rates are sufficient to support drainage over 48 hours. If this occurs, the design shall be more similar to a bioretention basin.	
	FILTRATION	
TC-40	<p>Sand or other Media Filter: Usually two-chambered with a pretreatment settling basin and a filter bed filled with sand or other absorptive filter media.</p> <p>Explanation/Description: Media filtration system shall be used to treat runoff from the roof of the parking structure as well as the dog park to enhance removal of organic compounds and improve nutrient and pathogen removal. Sand media is the currently being considered, however, a different media or combination of media with similar or better treatment performance may be substituted in final design.</p> <p>Runoff from the dog park shall receive a second treatment step in vegetated swales with check dams as described in above in TC-30. Runoff from the parking structure roof shall receive a second treatment step in the extended detention basin as described above in TC-22.</p>	YES
	FLOW THROUGH SEPARATION	
TC-50	<p>Water Quality Inlet: Vaults with chambers including screens, settling areas, and/or filter media to promote settling and/or separation of pollutants from stormwater.</p> <p>Explanation/Description: Subsurface water quality inlets shall not be used. Other BMPs shall be implemented to meet the requirements of the WQMP.</p>	NO
MP-50	<p>Wet Vault: A vault with a permanent water pool and internal features to promote settling and/or separation of pollutants from stormwater.</p> <p>Explanation/Description: Wet vaults shall not be used. Other BMPs shall be implemented to meet the requirements of the WQMP.</p>	NO
MP-51	<p>Vortex Separator: Similar to wet vaults but round and use centrifugal action as primary separation mechanism.</p> <p>Explanation/Description: Vortex separators shall not be used. Other BMPs shall be implemented to meet the requirements of the WQMP.</p>	NO
MP-52	<p>Drain Inserts: Boxes, trays, or socks with screens or filter fabric and may also include filter media. They are installed in inlets or catch basins and removal effectiveness for pollutants is generally low except for large sediment.</p>	NO

<i>Explanation/Description:</i> Drain inserts shall not be used. Other BMPs shall be implemented to meet the requirements of the WQMP.	
<i>OTHER</i>	
TC-60	<p>Multiple Systems: A system that uses two or more BMPs in series to increase treatment. Useful when one BMP does not provide sufficient treatment alone.</p> <p><i>Explanation/Description:</i> Multiple systems shall be used in two instances at the site. Both the dog park and parking structure runoff shall flow through a media filter system before being retained in an extended detention basin.</p> <p style="text-align: right;">YES</p>

4.3.1 Treatment BMP Sizing

All runoff from the WQE shall be treated in one or more of the treatment BMPs described above. Of the BMPs utilized, vegetated swales with check dams and extended detention basins are most frequently incorporated into the plan. To size the BMPs, the stormwater quality design volume (SQDV) and stormwater quality design flow (SQDF) were estimated based on the methods described in the Orange County Model Water Quality Management Plan including Exhibit 7.11 in the Orange County Drainage Area Management Plan (County of Orange, 2003).

The Rational Method was used to estimate the SQDF as follows:

$$Q = CIA$$

Where:

Q = the SQDF in cubic feet/ second (cfs);

I = the rainfall intensity in ft/hour for the 24-hour, 85th percentile rainfall event. Defined as 0.2 inches per hour (0.167 ft/hour) in the Model Water Quality Management Plan (County of Orange, 2003); and

A = the sub-drainage area in square feet.

To estimate the SQDV the Rational Method is modified as follows:

$$V_b = CIA$$

Where:

V_b = the SQDV in ft³; and

I = the rainfall depth in ft for the 24-hour, 85th percentile rainfall event. As identified in Figure A-1 of the Model Water Quality Management Plan, the project lies within Rainfall Zone 1 and has a rainfall depth of 0.7 inches or 0.0583 ft.

The SQDV and SQDF values for each drainage area were adjusted to account for the use of planting media which are more effective at infiltrating and absorbing water than is assumed in the normal open space runoff calculations. The adjusted SQDV and SQDF values account for the anticipated storage of runoff within the soil profile. This was described in greater detail above in section 3.1.3. The normal and adjusted SQDV and SQDF values for each drainage area are indicated in Table 7.

Table 7. Normal and adjusted SQDV and SQDF values

Drainage ID	Normal SQDV (cf)	Adjusted SQDV (cf)	Normal SQDF (cfs)	Adjusted SQDF (cfs)
Ai	843	530	0.067	0.042
Aii	125	62	0.010	0.005
Aiii	2,563	2300	0.203	0.026
Aiv	1,967	1967	0.156	0.156
Av	206	0	0.016	0.000
A subtotal	5704	4859	0.453	0.230
Bi	184	40	0.015	0.003
Bii	1,417	109	0.112	0.009
Biii	208	124	0.017	0.010
Biv	526	251	0.042	0.020
Bv	2,549	2359	0.202	0.187
Bvi	427	193	0.034	0.015
Bvii	228	125	0.018	0.010
B subtotal	5539	3201	0.440	0.254
Ci	14,494	13298	0.833	0.738
Cii	196	0	0.016	0.000
Ciii	745	538	0.059	0.043
C subtotal	15435	13836	0.908	0.781
Di	707	326	0.056	0.026
Ei	353	317	0.008	0.005
Eii	648	583	0.013	0.007
Eiii	1,214	1179	0.021	0.018
E subtotal	2214	2078	0.041	0.030
Total Area	29600	24300	1.897	1.320

4.3.1.1 Vegetated swales with check dams

Typically, vegetated swales are sized based on the SQDF. However, in this case, the swales have been sized to infiltrate the SQDV rather than pass the SQDF. This differentiation essentially changes the swales to a series of elongated infiltration devices with subsurface drainage pipes. The incorporation of check dams provides some retention time for the stormwater, promoting settling, as well as slowing down the flow to prevent erosion, scour and short circuiting. Swales on shallow slopes, less than about 2%, will not require check dams. By infiltrating rather than passing the SQDV, the runoff shall receive additional filtration through the soil layers. If subdrains are found to be infeasible in particular locations due to the root structure of landscaped trees, standpipes will be considered as a drainage alternative.

The swale freeboard was set such that the overall conveyance capacity of swales within the project area was adequate to carry the 10-year storm event flows. This constraint was typically the limiting factor in setting the overall swale dimensions. Swales were sized to

have either 3 to 1 slopes or vertical slopes. The image in Figure 6 provides an example where steeper side slopes have been reinforced. The final design of any given swale may incorporate sections with shallow side slopes as well as sections with steeper side slopes to accommodate site grading constraints. Furthermore, the indicated swale dimensions are capable of accommodating the entire 10-year flows. In practice however, the upper reaches of the swales will carry less flood water than the lower reaches. For this reason, the final design may include a tapering of the width, achieved by a reduction in freeboard, towards the upper swale reaches. This will not affect the ability of the swale to infiltrate the SQDV as the swale bottom widths will remain the same as indicated here.

A summary of the swale sizing calculations is provided in Table 8. A built example of a vegetated swale with check dams is provided in Figure 6. A schematic of the proposed design is provided in Figure 7.

Vegetated swales within drainage area B generally drain to the wetland area. Prior to reaching the wetland, the swales shall be culverted either directly under or adjacent to the bridge structures. These points of discharge to the wetland shall be protected against erosion by using appropriate flow dissipation structures.

Figure 6: Vegetated swale with check dams.

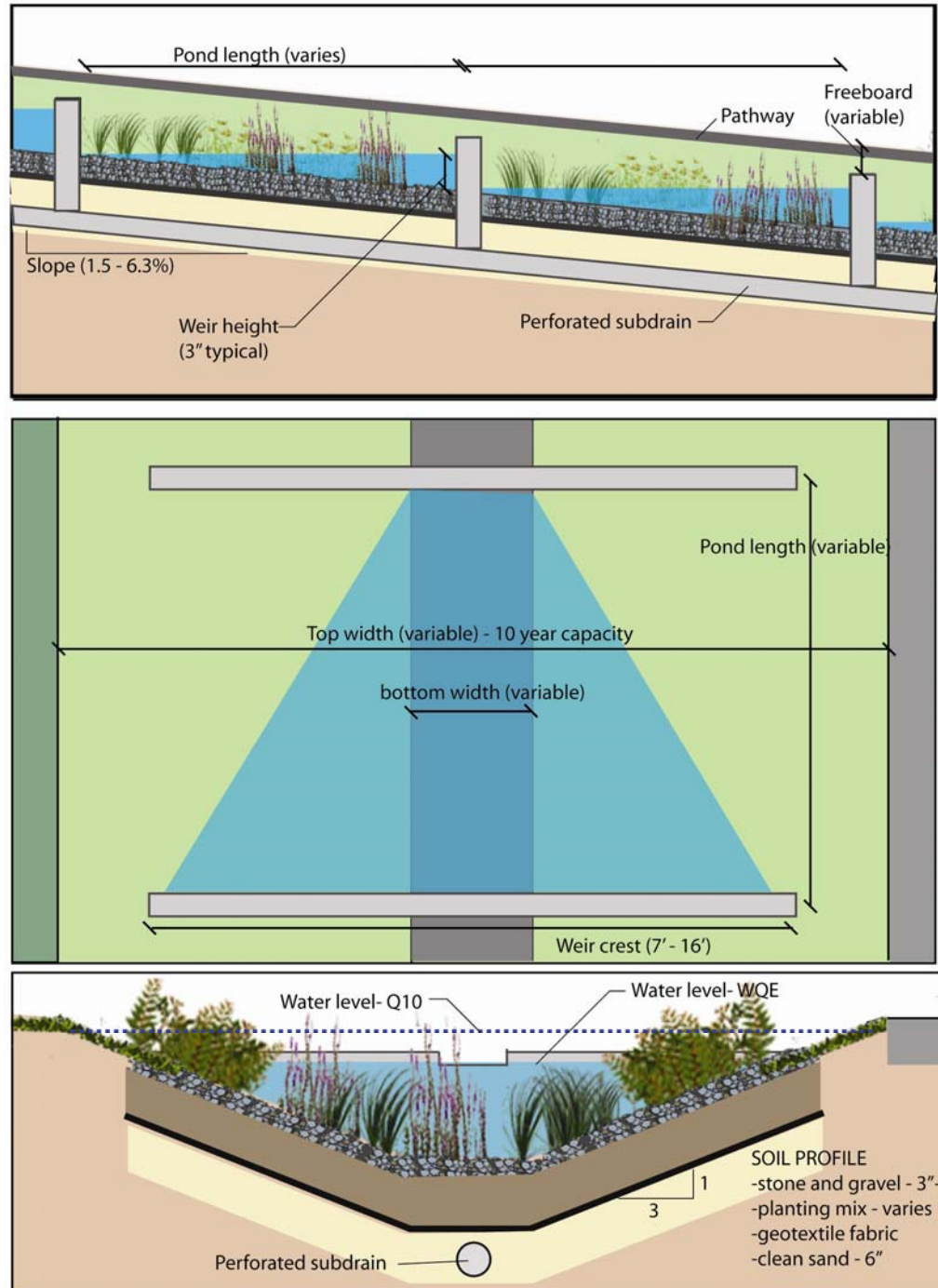
Image is for illustrative purposes only and not intended to be indicative of specific engineering details.



Figure 7: Preliminary schematic design - vegetated swale with check dams

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Vegetated swale with check dams



4.3.1.2 Extended detention basins

The current site design includes seven extended detention basins serving drainage areas Ai, Ci, Ciii, Di, Ei, Eii, and Eiii, each sized based on the SQDV of its contributing sub-drainage area.

Generally, detention basins shall employ subsurface perforated drain pipes. This method is preferred over perforated standpipes as it allows runoff to be filtered through the soil media, essentially performing the same function as a media filter. However, detention basins with more deeply rooting vegetation, particularly the basin serving drainage area Ci, will have perforated stand pipes to slowly release water from the basins over a period of 48-hours. This is to accommodate the use of more deeply rooted vegetation which can clog subsurface drains. The basin serving the dog park shall drain via a subsurface perforated pipe. The basins at the south end of the site serving drainage areas Ci, Ciii, Di, Ei, Eii, and Eiii may require an impermeable liner in order to reduce the risk of damage to the library basement and building foundations. Engineered soils shall consist of a layer of planting mulch followed by a geotextile fabric and clean fine sand. The depth of these soils shall depend upon the planting palette.

The drains for detention basins Ci, Ciii, Di, Ei, Eii, and Eiii may flow to a subsurface rainwater harvesting cistern. When the cisterns are full, all flows will be routed to the storm drains. An overflow will be provided for each dry detention basin to allow for higher flows to be discharged to the storm drain. The subdrain and overflow for the detention basin serving drainage area Di shall drain to the municipal storm drain along Avocado Ave.

A summary of the extended detention basin sizing is provided in Table 9. Note that for the dry detention basins in sub-drainage areas Ci, Ei, Eii, and Eiii an additional volume has been added to the SQDV for peak flow management. The combined additional volumes in drainage areas E and Ci are 1600 and 4000 cubic feet respectively as noted in the drainage report (Arup 2009).

Figure 8 provides a built example of an extended detention basin. Figure 9 provides a preliminary typical schematic of the proposed design including both perforated subdrain and standpipe options.

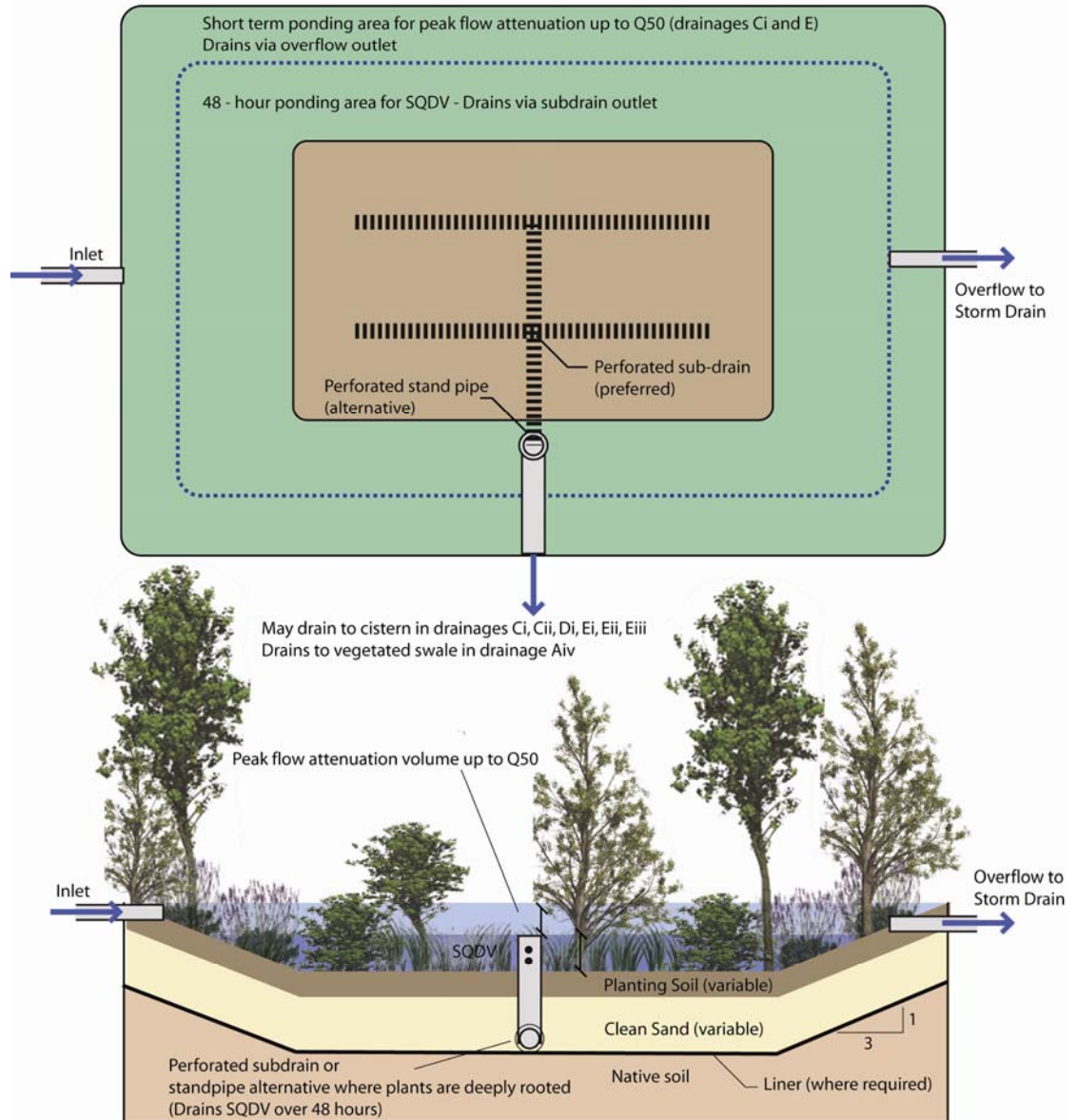
Figure 8: Small extended detention/bioretention basin.

Image is for illustrative purposes only and not intended to be indicative of specific engineering details.



Figure 9: Preliminary schematic design – extended detention basin

ARUP

Detention basin with subdrain**4.3.1.3 Vegetated filter strips**

Vegetated filter strips are used at the site as primary treatment BMPs adjacent to the wetland area. They are only used to treat runoff from landscaped areas when there is no opportunity to create a vegetated swale between the pathways and the wetland channel. Vegetated filter strips will be a minimum of 10 feet wide and consist of dense ground cover vegetation that requires minimal to no fertilizer or pesticide application.

4.3.1.4 Media filters

Sand or other media filters will perform the first step of a multi step treatment process for runoff from the parking structure and the dog park. In both cases, effluent from the media filters would discharge to additional downstream treatment BMPs.

Sand filters are typically two-chambered systems that temporarily store storm water runoff and allow it to filter through a layer of sand or other media for treatment before discharging downstream. There are several design variations for sand filters, including Austin Sand Filters, Delaware Sand Filters, and underground filters. In general, sand filters feature a pre-treatment basin or chamber to allow large particulates to settle out, and a filtration chamber where storm water runoff is filtered through a layer of sand (typically 18-in deep at a minimum). In addition, there are several proprietary units available that function similarly to traditional design-build media filter systems. These types of media filter units (e.g., StormFilter® by Contech Stormwater Solutions, Inc., BayFilter™ by Bay Saver Inc., Up-Flo Filter by Kristar Enterprises, Inc, among others) are proprietary, structural BMPs installed underground within the storm drain system. They typically consist of a pre-cast vault storm drain insert containing media-filled cartridges or a media-filled chamber to trap and adsorb particulates and pollutants in storm water runoff. Typical media types include perlite, zeolite, activated carbon, activated alumina, and leaf media. Targeted pollutants include total suspended solids (TSS), oil & grease, soluble metals, nutrients, organics, trash and debris and occasionally bacteria, depending on the system design. Traditional media filters are typically designed to filter the design capture volume over a period of 48 hours.

Specific details, including filter and media types, have not been finalized. Selection of an appropriate filter type shall be based on a number of factors including effectiveness, cost, maintenance requirements, and aesthetic impacts. Filter types currently being considered include Austin Sand Filters, Delaware Sand Filters, and naturalized open basin filters.

Figure 10: Treatment BMPs



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Note: BMP sizes are indicative of the space required for treatment only.

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Table 8: Vegetated swale with check dams: sizing overview

Drainage ID	top width (ft)		Swale length (ft)	swale avg slope	Adjusted SQDV ¹ (cf)	Total volume infiltrated over length of swale (cf/ 24hours)	Freeboard (ft)		Q Max (cfs)	Q Max (cfs)	Swale max capacity (cfs)		Q-10 (cfs)
	side slope 3:1	vertical sides					side slope 3:1	vertical sides	side slope 3:1	vertical sides	side slope 3:1	vertical sides	
Ai	6.3	1.9	384	0.018	530	530	0.65	1.00	0.70	0.60	0.70	0.60	0.59
Aii	3.9	1	138	0.020	62	62	0.35	0.75	0.09	0.09	0.09	0.09	0.09
Aiii	7.5	2.8	748	0.040	2300	2300	0.70	1.00	1.80	1.89	1.80	1.89	1.78
Av	4.3	1.1	250	0.016	0	0	0.45	1.00	0.15	0.17	0.15	0.17	0.14
Bi	4.2	1	90	0.028	40	40	0.40	0.90	0.15	0.16	0.15	0.16	0.13
Biii	4.1	1	162	0.044	124	124	0.35	0.80	0.14	0.16	0.14	0.16	0.14
Biv	5.1	1.3	563	0.033	251	251	0.55	1.00	0.44	0.37	0.44	0.37	0.37
Bv	8.5	3.5	413	0.063	2359	2359	0.60	0.90	2.13	2.76	2.13	2.76	1.77
Bvi	4.5	1	382	0.040	193	193	0.45	1.00	0.26	0.22	0.26	0.22	0.26
Bviii	4.4	1	175	0.040	125	125	0.40	0.90	0.20	0.18	0.20	0.18	0.16
Cii	4	1	870	0.040	0	0	0.40	0.80	0.16	0.15	0.16	0.15	0.14

¹ Adjusted to account for absorption of a portion of SQDV within open space soil profile.

Table 9: Extended detention basin: sizing summary

Drainage Area	SQDV (ft³)	Total Depth (ft)	Side Slope	bottom width (ft)	bottom length (ft)	Freeboard (ft)	Pond Volume (ft³)	Area (sqft)	Top width (ft)	Top length (ft)
Ai	351	1.5	3	1	42	0.25	353	604	11.5	52.5
Ci¹	13626	2.6	3	58	73	0.25	13665	6767	75.1	90.1
Ciii	538	2	3	4	25	0.25	548	674	17.5	38.5
Di	377	1.5	3	7	19	0.25	375	516	17.5	29.5
Ei²	864	1.5	3	16	25	0.25	877	941	26.5	35.5
Eii²	748	1.5	3	14	24	0.25	761	845	24.5	34.5
Eiii²	402	1.5	3	5	26	0.25	404	566	15.5	36.5
¹ - Includes 4000 cubic feet storage space for peak flow reduction during events larger than the WQE in drainage area C										
² - Includes 1600 cubic feet combined additional storage for peak flow reduction in drainage area E										

4.3.2 Treatment BMP Water Quality Performance

The US Geological Survey (USGS) regression model developed by Driver and Tasker was used to estimate pre- and post-development runoff quality for a selection of parameters (Driver and Tasker, 1990). Post-development performance in this case is without proposed BMPs. The regression model was developed based on measurements of runoff quality from sites around the United States. Estimates of other pollutants such as bacteria and viruses were not available from this model. The model was run for a water quality rainfall event with 0.7 inches of rainfall over a 24-hour period.

Pollutant loads for the post-development condition with proposed BMPs were estimated using treatment BMP removal rate data from the Center for Watershed Protection: National Pollutant Performance Removal Database (NPPRD) (2007). Both the proposed design of the vegetated swales and detention basins are functionally similar to infiltration devices in that the SQDV passes through the soil profile including 12" of sand. In addition the swales provide bio-filtration in the vegetated portion of the swale as well as settling via ponding behind the small check dams. The detention basins also provide settling via ponding. Therefore, the expected removal rates for the proposed BMPs are anticipated to be similar or better than removal rates for infiltration devices. Removal rates for infiltration devices published by the NPPRD are provided below in Table 10.

Table 10: Pollutant Removal Rates through Infiltration Devices

Source: Center for Watershed Protection, 2007

Parameter	Removal Rate
TSS	89%
TP	65%
DP	85%
TN	42%
Cu	86%
Zn	66%

4.3.2.1 Water Quality Results Summary

Results of the water quality modeling exercise are provided below in Table 11

This modeling exercise provides an indicative estimate of the pollutant concentrations and loads from the site as well as BMP performance. Actual pollutant concentrations and loading may be different than estimated here. The predicted performances do not account for the site design or source control BMPs nor the additional treatment provided by both the media filters and multiple treatment steps at the dog park and parking structure. The estimates of impacts are therefore conservative.

The swales and detention basins shall generally provide high removal efficiency for the pollutants identified in Table 3. As indicated in Table 11, implementation of the BMPs has the potential to result in lower pollutant loading from the site compared to existing conditions for Suspended Solids (SS), Total Phosphorus (TP), Dissolved Phosphorous (DP), Total Nitrogen (TN), Total Copper (Cu), and Total Zinc (Zn). Furthermore, the project will also treat runoff from portions of Avocado Avenue and San Miguel Drive. This additional treatment contributes to a further reduction of pollutant loading resulting from the City Hall site. As indicated in Table 11, the results in a negative final load for SS, DP, and Cu. The estimated total reduction in pollutant loading compared to existing conditions is provided in

the final column of Table 11. Load reductions are anticipated as a result of the project for each of the modeled pollutants.

Table 11: Pollutant Modeling Results

Water Quality Parameter	Site Pollutant Load			Load Reduction from Treatment of Runoff from Avocado and San Miguel	Final Load	Total Load Reduction Compared to Existing Condition
	Existing ¹	Post-Development ¹	Post-Development with BMPs ²			
SS (lb)	5.12	4.87	0.54	0.59	-0.06	-5.18
TN (lb)	2.11	3.38	1.96	0.27	1.69	-0.42
TP (lb)	0.53	0.77	0.27	0.24	0.03	-0.50
DP (lb)	0.20	0.25	0.04	0.07	-0.04	-0.24
Cu (lb)	0.04	0.07	0.01	0.02	-0.01	-0.06
Zn (lb)	0.41	0.55	0.19	0.08	0.10	-0.30
¹ Driver and Tasker, 1990						
² Center for Watershed Protection: National Pollution Performance Removal Database, 2007.						
³ Negative number indicates that the load reduction is greater than the site pollutant load with BMPs.						
Note: Actual performance may vary from model results.						

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